removal when the heads are rounded off heretofore devised and utilized for the purpose of removing fasteners when the heads thereof have become rounded off are known to consist of the familiar, expected and obvious structural configurations, notwithstanding the myriad of designs encompassed by the crowded prior art which have been developed for the fulfillment of countless objectives and requirements.

By way of example, the prior art discloses in U.S. Patent 5,551,320 to Horobec discloses a socket with V-shaped teeth spiraled in a tapered cylinder. Both sides of the V are essentially equal length and angle. This tool is stronger than the Jordan tool 6,339,976 but still lacks the initial bite when starting the tool.

U.S. Patent Number 5,123,310 to McManus a socket for turning fastener heads having deformed head surfaces. This tool cannot remove a damaged fastener from inside a cylindrical body.

U.S. Patent Number 4,607,547 to Martus discloses a stripped hex head drive socket. This tool lacks the commonality for a standard fastener to say nothing of the cost to manufacture the tool or bolt.

U.S. Patent Number 4,084,454 to Day discloses an elaborate socket head tool which requires a tapping on the exterior of the tool while turning. This tool works on a vibration force.

U.S. Patent 6,339,976 to Jordan discloses a socket with a partly hexed interior and distorted V-shaped teeth with distorted V-shaped valleys. The volume of teeth reduce the gripping power and the distorted V-shaped valleys weaken the exterior walls. In addition this tool lacks the capability to remove an undamaged fastener and a damaged fastener of the same size.

Lastly, U.S. Patent Number 3,996,819 to King discloses a socket wrench attachment similar to applicant's invention but lacks the integral teeth, the working side of teeth faces are essentially angled and tapered and the pass through hole for stud removal.

In this respect, the tool for the removal of damaged fasteners such as nuts, bolts and studs according to the present invention substantially departs from the conventional concepts and designs of the prior art, and in so doing provides an apparatus primarily developed for the purpose of removing damaged fasteners wherein the heads

have been rounded off through the use of sockets having teeth capable of biting into such heads and damaged fasteners from long threaded studs in addition to easy removal of the damaged fastener from the tool, this same tool will accept and undamaged fastener as well.

Therefore, it can be appreciated that there exists a continuing need for new and improved tool for the removing of damaged fasteners such as nuts, fasteners and studs which can be used for removing damaged fasteners wherein the heads have been rounded off as through the use of sockets having teeth capable of biting into such heads, and accepts undamaged fasteners as well. In this regard, the present invention substantially fulfills this need.

SUMMARY OF THE INVENTION:

Cancel the complete section "SUMMARY OF THE INVENTION" and substitute SUMMARY OF THE INVENTION as follows:

In view of the foregoing disadvantages inherent in the known types of socket heads for removing damaged and undamaged fasteners and techniques for facilitating such removal when the heads are rounded off now present in the prior art, the present invention provides an improved tool

for the removing of damaged fasteners, such as nuts, bolts and studs and nuts or fasteners from long threaded studs. As such, the general purpose of the present invention, which will be described subsequently in greater detail, is to provide a new and improved tool for the removing of damaged fasteners, such as nuts, bolts and studs apparatus and method which has all the advantages of the prior art and none of the disadvantages.

To attain this, the present invention essentially comprises a new and improved tool for the removing of damaged fasteners with rounded off heads from nuts comprising, in combination, a socket head having a partly cylindrical external configuration with an upper end and a lower end. The upper end has several flat projections that extend beyond the cylindrical body which allow it to receive a verity of socket or wrench configurations. The top of the upper end has a square recess adapted to receive the end of a driver or ratchet wrench. The lower end of the tools head is fabricated with a major recess of a generally frustroconical configuration with a length constituting 50 percent or less of the overall body length. The major recess has an interior surface formed with a plurality of inverted L-shaped projections and the legs of the inverted L-shaped projections are at slight angles and

depending on the fastener the angle of each tooth can be between 102 degrees and 105.30 degrees and have a radius at the base of both legs and the point of these inverted L-shaped projections can gradually flatten out past midway of the major recess to the major recess smaller diameter and these projections are integral with the socket and extending radially inwardly from the lower end with valleys intermediate the inverted L-shaped projections, thereby forming a plurality of angles with radially interior teeth. Each of the angles has an apex with two faces. The face of each angle is offset from the radius of the cylinder. The apex of each tooth is angularly oriented at a 12 Degree helix with respect to the axis of the cylinder. The axial interior of the major recess has a smaller diameter than the axial exterior of the major recess. The major recess continues through the socket head beyond the projections into and through the square drive at the upper end whereby when placed over the head of a damaged of a fastener, the socket head is rotated with a ratchet motion. The teeth will pull downwardly over and into the damaged fastener biting into its exterior surface to effect a coupling therebetween for rotation of the socket head and associated fastener to effect its removal. The damaged fastener can be easily removed from this tool, in addition this tool will accept an undamaged fastener as well.

There has thus been outlined, rather broadly, the more important features of the invention in order that the detailed description thereof that follows may be better understood, and in order that the present contribution to the art may be better appreciated. There are, of course, additional features of the invention that will be described hereinafter and which will form the subject matter of the claims appended hereto.

In this respect, before explaining at least one embodiment of the invention in detail, it is to be understood that the invention is not limited in its application to the details of construction and to the arrangements of the components set forth in the following description or illustrated in the drawings. The invention is capable of other embodiments and of being practiced and carried out in various ways. Also, it is to be understood that the phraseology and terminology employed herein are for the purpose of description and should not be regarded as limiting.

As such, those skilled in the art will appreciate that the conception, upon which this disclosure is based, may readily be utilized as a basis for the designing of other structures, methods and systems for carrying out the

several purposes of the present invention. It is important, therefore, that the claims be regarded as including such equivalent constructions insofar as they do not depart from the spirit and scope of the present invention.

It is therefore an object of the present invention to provide a new and improved tool for the removing of damaged fasteners, such as nuts, bolts and studs which has all the advantages of the prior art socket heads for removing fasteners and techniques for facilitating such removal when the heads are damaged or rounded off and none of the disadvantages, as well as accepting undamaged fasteners.

It is another object of the present invention to provide a new and improved tool with much greater gripping ability for the removal of damaged fasteners such as nuts, bolts and studs which may be easily and efficiently manufactured and marketed and a wedge proof removal of the damaged fastener from the tool.

It is a further object of the present invention to provide a new and improved tool for the instillation and removal of undamaged fasteners such as nuts, bolts and

studs which is stronger and of a durable and reliable construction.

An even further object of the present invention is to provide a new and improved tool for the removing of damaged fasteners such as nuts, bolts and studs and removal of the damaged fastener from the tool, all of which is susceptible to low cost of manufacturing with regard to both materials and labor, and which accordingly is then susceptible of low prices of sale to the consuming public, thereby making such a tool for removing damaged fasteners and techniques for facilitating such removal when the heads are rounded off economically available to the buying public.

Still yet another object of the present invention is to provide a new and improved tool for the removing of damaged and undamaged fasteners such as nuts, bolts and studs which provides in the apparatuses and methods of the prior art some of the advantages thereof, while simultaneously overcoming some of the disadvantages normally associated therewith.

Still another object of the present invention is to remove damaged fasteners wherein the heads have been deteriorated from rust or rounded off as through the use of

an improper sized socket having teeth capable of gripping such heads.

Lastly, it is an object of the present invention to provide a new and improved device for the removal of undamaged and damaged fasteners with rusted or rounded off heads. The socket head has a partly cylindrical external configuration with an upper end and a lower end and with a square recessed surface in the upper end and is adaptive to receive the end of a turning tool. The lower end of the socket head is fabricated with a major recess of a generally frustroconical configuration. The major recess has an interior surface formed with a plurality of inverted L-shaped projections the angle of each tooth can be between 102 degree and 105.30 degrees depending on the fastener but the optimum angle is 105 degrees and these projections are integral with the socket and extending radially inwardly 12 degrees from the lower end thereby forming a plurality of angles with radially interior teeth. Each of the angles has an apex with two faces. The faces of each angle are offset from the radius of the cylinder. The apex of each tooth is angularly oriented with respect to the axis of the cylinder. The axial interior of the major recess has a smaller diameter than the axial exterior of the major recess whereby when placed over the damaged fastener and

when the socket head is rotated with a ratchet motion, the teeth will pull downwardly over the damaged fastener and bite into its exterior surface to effect a coupling therebetween for rotation of the socket head and associated damaged fastener to effect its removal. The damaged fastener can easily be removed by tapping it out from the side with the square recess.

These together with other objects of the invention, along with the various features of novelty, which characterize the invention, are pointed out with particularity in the claims annexed to and forming a part of this disclosure. For a better understanding of the invention, its operating advantages and the specific objects attained by its uses, reference should be had to the accompanying drawings and descriptive matter in which there is illustrated preferred embodiments of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS:

Cancel the complete section for "BRIEF DESCRIPTION OF THE DRAWINGS" and substitute BRIEF DESCRIPTION OF THE DRAWINGS as follows:

The invention will be better understood and objects other than those set forth above will become apparent when consideration is given to the following detailed description thereof. Such description makes reference to the annexed drawings wherein:

Figure 1 is a sectional side view of the tool and a bottom view.

Figure 2 is an exploded perspective view of the tool and a open ended wrench and associated damaged fastener to be removed.

Figure 3 is a closed end wrench design for removing a damaged fastener.

Figure 4 is a pass through ratchet design for removing a damaged fastener on a long stud.

Figure 5a of Fig.5 is a bottom view of the tool with an undamaged nut inside and Figure 5b of Fig. 5 is a view of a single tooth's edge crossing the head of an undamaged bolt and Figure 5c of Fig.5 is a sectional view that shows one of the edges where the flats meet on the head of an undamaged fastener fully in the helix.

Similar reference characters refer to similar parts throughout the several views of the drawings.

DESCRIPTION OF THE PREFERRED EMBODIMENT:

Cancel the complete section for "DESCRIPTION OF THE PREFERRED EMBODIMENT" and substitute DESCRIPTION OF THE PREFERRED EMBODIMENT as follows:

With reference now to the drawings, and in particular to Figure 1 thereof, a new and improved tool for the removing of damaged fasteners such as nuts, bolts and studs embodying the principles and concepts of the present invention and generally designated by the reference numeral 10 will be described.

The present invention, the new and improved tool for the removal of damaged fasteners such as nuts, bolts and studs, which
comprise of a plurality of tools sizes. Such components for each tool are individually configured and correlated with respect to each other so as to attain the desired objective.

More specifically, the present invention is a tool 10 of different sizes for functioning with a different size damaged and undamaged fasteners to be removed. Each tool is formed of a partly cylindrical exterior configuration 12 at the lower end 14. The upper end 16 sides of the exterior have multiple parallel flats 18 that extend horizontally beyond the cylindrical lower end which allow for application of a wrench or socket in the removal process. The top 20 of upper end has a square recess 22 that continues partly into the tools interior 24. This square recess 22 is adapted to receive the end of a ratchet wrench or square driving devise in the conventional manner.

The lower end interior 14 of each socket head is fabricated with a recess 26. Such recess is of a generally frustroconical
configuration 28. Such configuration includes a plurality of inverted L-shaped projections 30 and depending on the fastener the angle 32 of each tooth will be between 102 degrees and 105.30 degrees but the optimum angle is 105 degrees and these projections are integral with the socket and 34 extending radially inwardly 12 degrees. Intermediate therebetween, the inverted L-shaped projections are a plurality of angles and radius bases 36 all of which create radially interior teeth. The edge 38 of each tooth is

angularity oriented with respect to the axis 40 of the cylinder.

The axial interior 42 of the recess has a smaller diameter than the axial exterior 44 of the recess. The tool 10 is shown containing an undamaged fastener 46 and 48 is an undamaged fastener that shows the length of a single tooth's biting edge 50 biting into one of and undamaged bolts flats 52 and the exterior flats 54 on the head of an undamaged fastener meet creating a v-shaped intersection 56. The edge of this intersection fits fully 58 into the tools helix.

In this manner, when placed over a damaged fastener, stud or nut, and counter clockwise rotated with a ratchet motion, the teeth pull the invention downwardly over the head of the fastener and bite into its exterior surface. This will effect a coupling between the socket head and the fastener. A clockwise rotation of the tool will easily removal of the fastener.

The present invention thus relates to apparatus for the removing of damaged fasteners such as studs or fasteners with rounded off interior and or exterior heads.

The apparatus comprises, in combination, a socket head having a partly cylindrical external configuration with an upper end and a lower end and an axis with a first axial length therebetween. The socket also has a square recess on the upper end adapted to receive the end of a ratchet wrench. It also preferably has flat regions 18 in its exterior surface, either 2, 4, 6, 8, etc, for receiving a wrench or ratchet or other turning tools. The lower end of the socket head is fabricated with a major recess of a generally frustroconical configuration.

The major recess has an interior surface formed with a plurality of inverted L-shaped projections and the legs of the inverted L-shaped projections are at slight angles and depending on the fastener the angle of each tooth will be between 102 degree and 105.30 degree but the optimum angle is 105 degrees and extending radially inwardly from the lower end. Fabricating the teeth integral with the socket head decreases the cost of fabrication as compared with separable teeth as exemplified by king while increasing the efficiency during use. The formation of the inverted L-shaped projections teeth, are integral with the socket head and are different from King and the rest of the prior art and reduces costs significantly with increasing efficiency in the use of the present invention. The Jordan tool

discloses a socket with distorted V-shaped teeth with distorted V-shaped valleys. The V-shaped valleys and the distorted teeth weaken the body and the combination of this many teeth creates a rubbing effect on the damaged fastener. We had this tool tested at the University of Florida Dept. of Engineering and this tool was proven to be weaker than the Horobec tool.

Depending on the fastener the angle of each tooth could vary between 102 degree and 105.30 degree but the optimum angle is 105 degrees and these projections are integral with the socket and extending radially inwardly at a 12 degree helix which creates much greater torque as the tool bites into the damaged fastener and yet allows for easier removal then the Horobec or King tool. Each of the angles has an apex with two faces of uncommon lengths. The faces of each angle are offset from the radius of the cylinder. The apex of each tooth is angularity oriented with respect to the axis of the cylinder. This arrangement of teeth allows an undamaged fastener to fit into the tool as well as damaged fasteners. When removing a damaged fastener the tool tightens and pulls down around the work-piece continually biting into the surface of a damaged fastener, when turned in one direction while allowing release when counter rotated. This is significantly different from the prior art as exemplified by King where the work-piece must

be beaten out of the socket. The axial interior of the major recess has a smaller diameter than the axial exterior of the major recess. The major recess continues through the socket head beyond the projections with a width greater than the diameter of the major recess at its axial interior. In this manner, when the socket is placed over a rounded off head of a damaged fastener, a portion thereof may extend beyond the projections. The prior art as exemplified by King has no such enlarged hole greater than the smallest diameter of the lower portion of the socket, and consequently, the prior art devices cannot remove nuts on elongated studs and does not normally accept undamaged fasteners. Further, when the socket head is rotated with a ratchet motion as in the present invention, the teeth will pull downwardly over the damaged fastener and bite into its exterior surface to effect a coupling therebetween. This allows for rotation of the socket head and associated damaged fastener to effect its removal.

The present invention is a tool for removing fasteners, studs and nuts with damaged heads. Frequently, when installing or trying to remove a fastener, stud or nut, a mechanic may chew up or round off its head, making it difficult to grab hold of the head with a conventional wrench or other tools. Studs become rusty and threads

worn. Other tools might have the capability of removing the damaged fastener, but once the fastener is removed it can't be removed from the tool easily if at all. The present invention pulls down to the base of the damaged fastener with a much greater force and the design of the angles on each leg, allows for easy removal of the damaged fastener from the tool. Also, it may be difficult to get to the damaged fastener due to a precarious location or limited amount of space. The present invention was conceived and a prototype in Fig.1 was fabricated by the inventor to address all these problems.

The present invention is a set of sockets that fit onto standard ratchets. They are made of hardened tool steel and could be sold in many sizes. The socket of the tool has very sharp teeth that surround its inner surface.

To remove a fastener, stud or nut with a damaged head, the mechanic attaches the proper size fastener remover to the ratchet wrench, places the socket over the damaged fastener and tighten the ratchet, thus drawing the sharp teeth tighter into the damaged fastener. The damaged fastener remover pulls itself down on the damaged fastener, stud or nut, enabling the tool to grab the head securely and remove the damaged fastener. Also, the tool is able to

reach hard to get at places by using different ratchet fittings and universal joints. For long studs the fastener remover would pull the stud until it reaches the base of the stud then it will bind and remove the stud.

The present invention makes it much easier to remove damaged fasteners with rounded off heads. It is a very practical and time saving tool for professional and amateur mechanics.

As to the manner of usage and operation of the present invention, the same should be apparent from the above description. Accordingly, no further discussion relating to the manner of usage and operation will be provided.

With respect to the above description then, it is to be realized that the optimum dimensional relationships for the parts of the invention, to include variations in size, materials, shape, form, function and manner of operation, assembly and use, are deemed readily apparent and obvious to one skilled in the art, and all equivalent relationships to those illustrated in the drawings and described in the specification are intended to be encompassed by the present invention.